

Utilizing Green Infrastructure to Protect Public Health at Beaches: *A Case Study in Suttons Bay, MI*



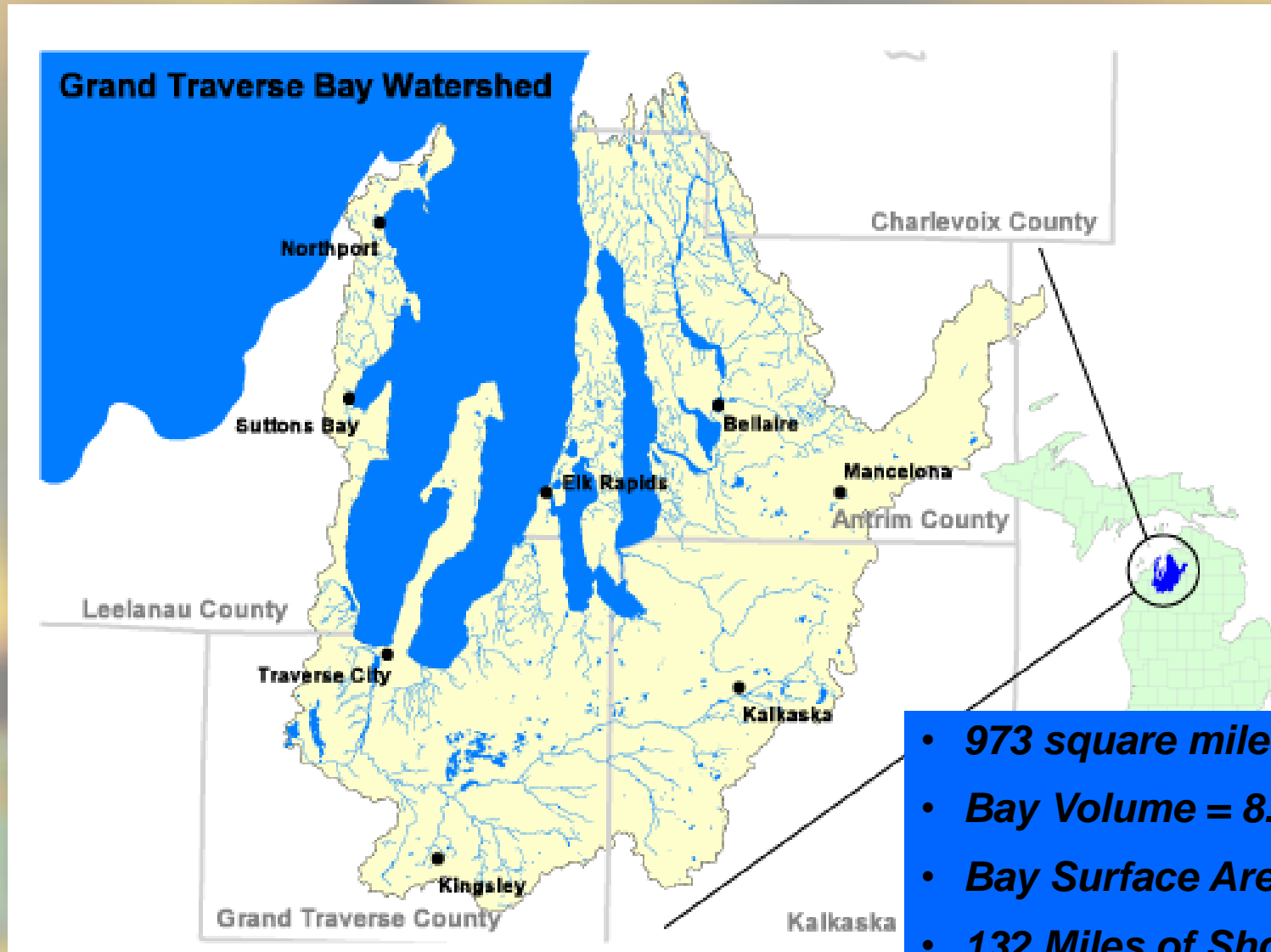
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Our Mission:

The Watershed Center advocates for clean water in Grand Traverse Bay and acts to protect and preserve the Bay's watershed

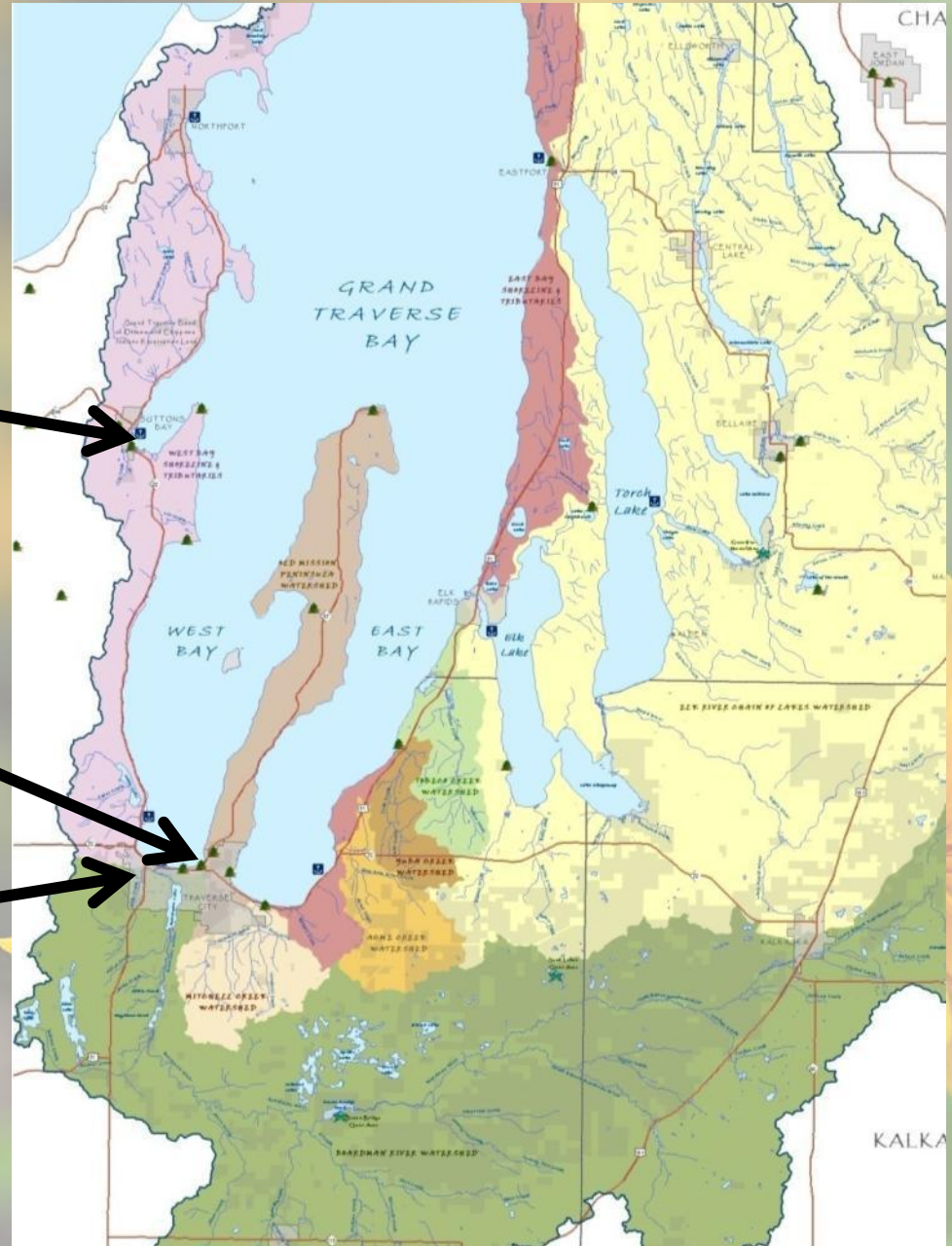
Grand Traverse Bay Watershed




- ***973 square miles***
- ***Bay Volume = 8.97 mi^3***
- ***Bay Surface Area = 277 mi^2***
- ***132 Miles of Shoreline***
- ***4 Counties, 44 townships, 11 municipalities***

Large-scale GI/LID Projects in GT Bay Watershed:

- Suttons Bay - \$987,102 (GLRI)
- Bryant Park - \$267,755 (GLRI/MDEQ)
- Kids Creek Restoration –
\$499,741 (GLRI)
\$642,000 (MDEQ)

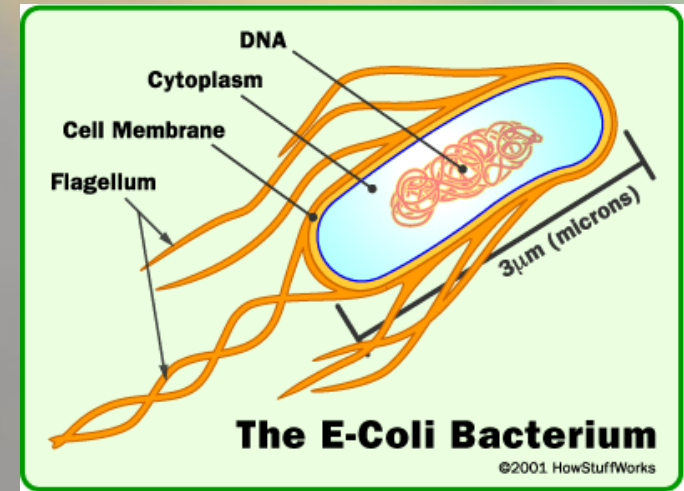


The background of the slide features a soft-focus photograph of numerous yellow flowers, likely Black-eyed Susans, with dark brown centers. The flowers are scattered across the frame, with some in sharp focus in the lower right and others blurred in the background, creating a natural and vibrant setting.

Stormwater Impacts to Public Health

Pathogen/Bacterial Inputs and Public Health

- Pathogens: Organisms that cause disease; include bacteria, viruses, protozoa
 - Present in water, hazardous to public health
- E.Coli is commonly measured as indicator of fecal contamination which contains pathogens
 - Kinds measured in recreational water do not generally cause disease
 - Indicator for the presence of other disease causing pathogens
 - EPA studies: when E. coli in fresh water exceeds water quality standards, swimmers are at increased risk of developing gastroenteritis (stomach upsets) from pathogens carried in fecal pollutions.



Clinch Park in Traverse City

Pathogen/Bacterial Inputs and Public Health

MI Water Quality Standards:

Water is considered unsafe for swimming if...

- 300 E. coli per 100mL of water are present in a single sample
- More than 130 E. coli are present in 100mL of water in 5 samples over 30 days, or if more than

GT Region Health Departments:

- Samples between 300-999 col/100mL have an advisory posted to not enter the water above the waist
- Samples over 1,000 col/100mL post an advisory to not enter the water at all



Water quality monitoring sign for GT County beach

Pathogen/Bacterial Inputs in Stormwater

- Stormwater is major pathway for E.Coli to enter water –
 - Pet waste, ducks/geese, animals in catch basins, parking lot runoff, human waste (leaking sanitary or septics)
 - Storm drain pipes good medium for cultivating bacterial growth
- Beaches in urban areas frequently located next to or near stormdrain outlets
- 2007 – Great Lakes Beach Sanitary Survey Pilot Project
 - Investigated potential sources of contamination at beaches
 - GTBay beach advisories related to storm events



Many sources of Pathogen contamination to stormwater runoff

Pathogen/Bacterial Inputs in Stormwater

- Additional monitoring at outlets has shown elevated and extremely high E.Coli during storm events

**E.Coli monitoring data (col/100mL) collected by
TWC on storm drains in Traverse City during 2012 rain events**

	7/3/12	7/25/12	8/16/12	9/7/12
Bryant Park	61,300	21,430	241,920	198,630
East Bay Park (north)	14,700	19,180	19,350	241,920
Sunset Park	130,000	5,760	111,990	7,890
West End (east)	1,200	1,850	19,180	--
West End (west)	4,400	1,850	5,460	12,740

**All these drain outlets are located next to or near public beaches*

*** Keep in mind a beach water reading of 300 col/100mL spurs an Advisory*

The background of the slide features a soft-focus photograph of numerous yellow flowers, likely Black-eyed Susans, with dark brown centers. The flowers are scattered across the frame, with some in sharp focus in the foreground and others blurred in the background, creating a sense of depth. The overall color palette is warm, dominated by the yellows and greens of the flora.

Suttons Bay Stormwater Remediation

Project Overview:

Issues:

- Three main storm drains outlet to Suttons Bay: Grove, Madison, Broadway St Drains
- Potential bacterial contamination at nearby public beaches (public health risk)
- Nutrient loading to nearshore waters



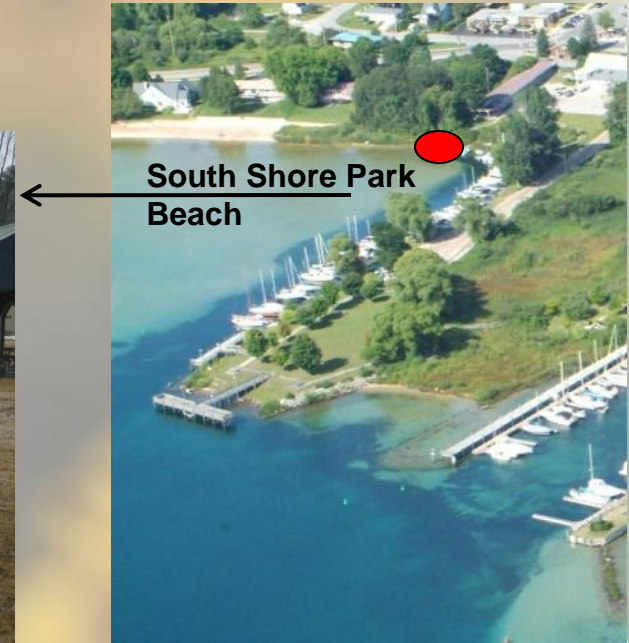
Process:

- Use LID/green infrastructure concept and decentralized approach
- Reduce runoff before end-of-pipe

Monitoring Results:

Beach Monitoring:

E.Coli advisories posted at least once every two summers (2001-2014) and 3 times in 2004



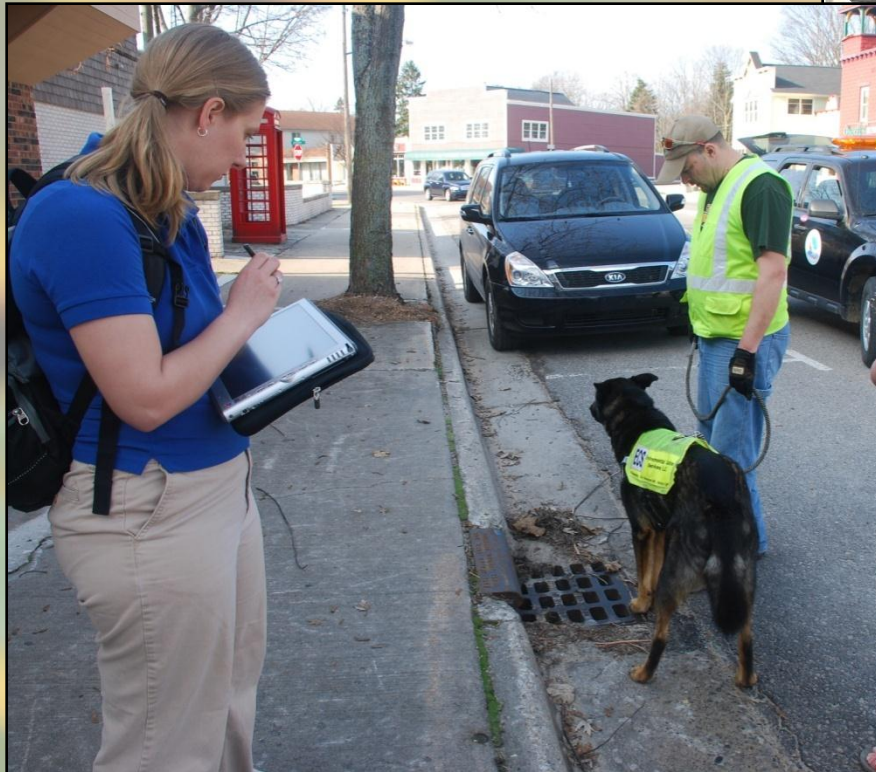
Storm Drain Monitoring:

	6/1/12	7/19/12	7/25/12
Grove Drain	3	14,500	1,220
Madison Drain	>2419	48,000	41,060
Broadway Drain	980	10,500	300

Monitoring Results:

Source Tracking E.Coli – is bacteria human or animal derived?

- Utilized canine unit trained to detect human sewage
- No 'hits' = no human sources of E.Coli
- Quickly verified E.Coli levels are animal sourced rather than human sourced
- Developed BMPs accordingly



Environmental Canine Services (Scott and canine Sable) inspect storm drains in Suttons Bay, looking for human sourced bacteria

Planned System:

- Increase infiltration and reduce amount of runoff making it to pipe outlets:

- ✓ Rain Gardens
- ✓ Underground Infiltration Trenches

Rain Gardens

Infiltration Trenches



Planned BMP System: Raingardens



Installation Steps:

1. Cut out pavement
2. Excavate depression for raingarden
3. Plant garden, replace sidewalk if necessary

Planned BMP System: Raingardens

15 installed in residential areas in Village

Treatment Steps:

1. Runoff enters garden, fills depression, and infiltrates naturally to ground
2. Excess water spills into the storm system inlet
3. Will eventually make its way to infiltration trench (discussed later)



Southwest corner of Adams St and St. Joseph Ave (M-22)



Southwest corner of St. Mary's Ave and Broadway Ave

Planned BMP System: Installation of Raingardens (before and after)



Northwest corner St. Mary's
and Broadway Ave

Planned BMP System: Installation of Raingardens (before and after)



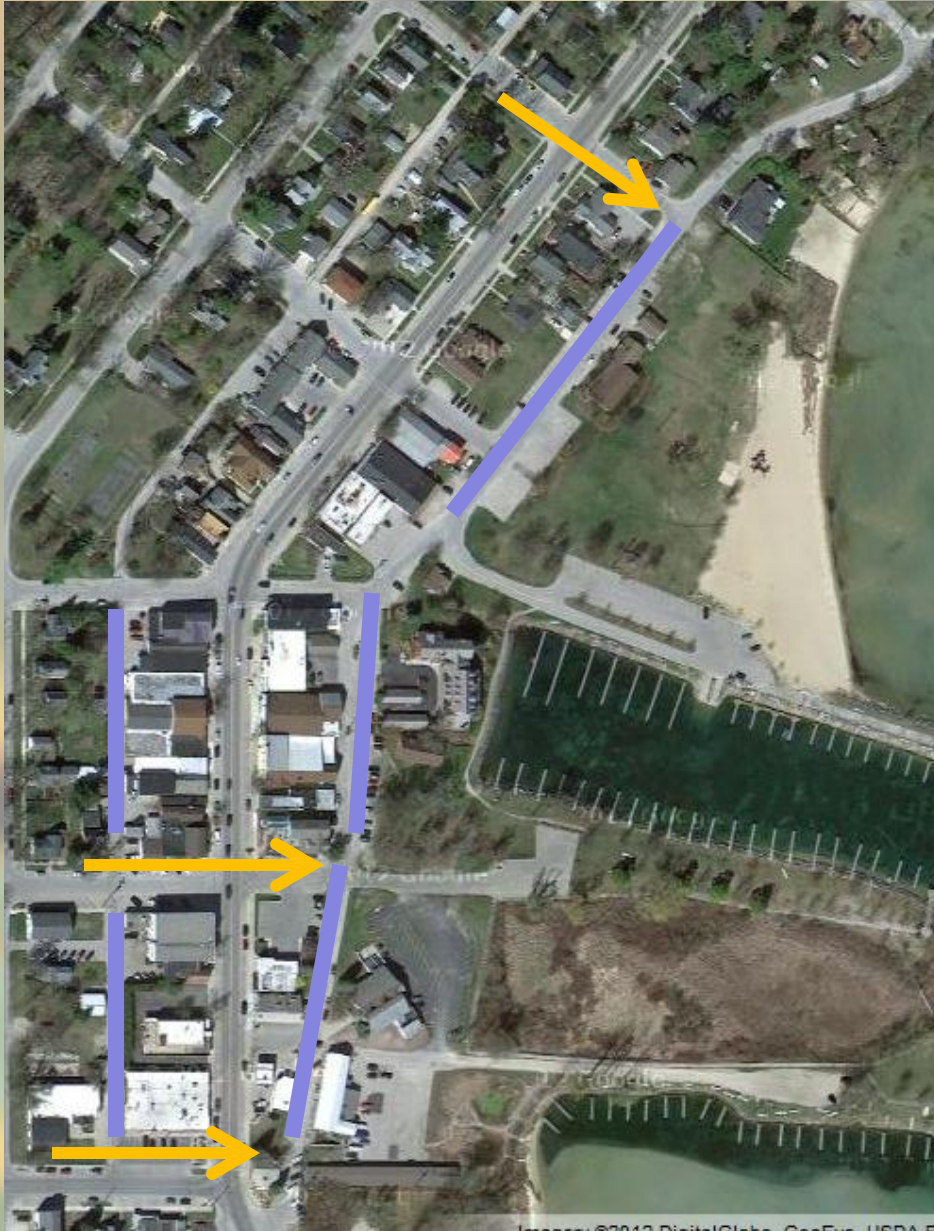
Southwest corner Madison Ave and M-22

Planned BMP System: Installation of Raingardens (before and after)



Broadway Ave, east
of Elm Street

Planned BMP System: Infiltration Trenches



Where:

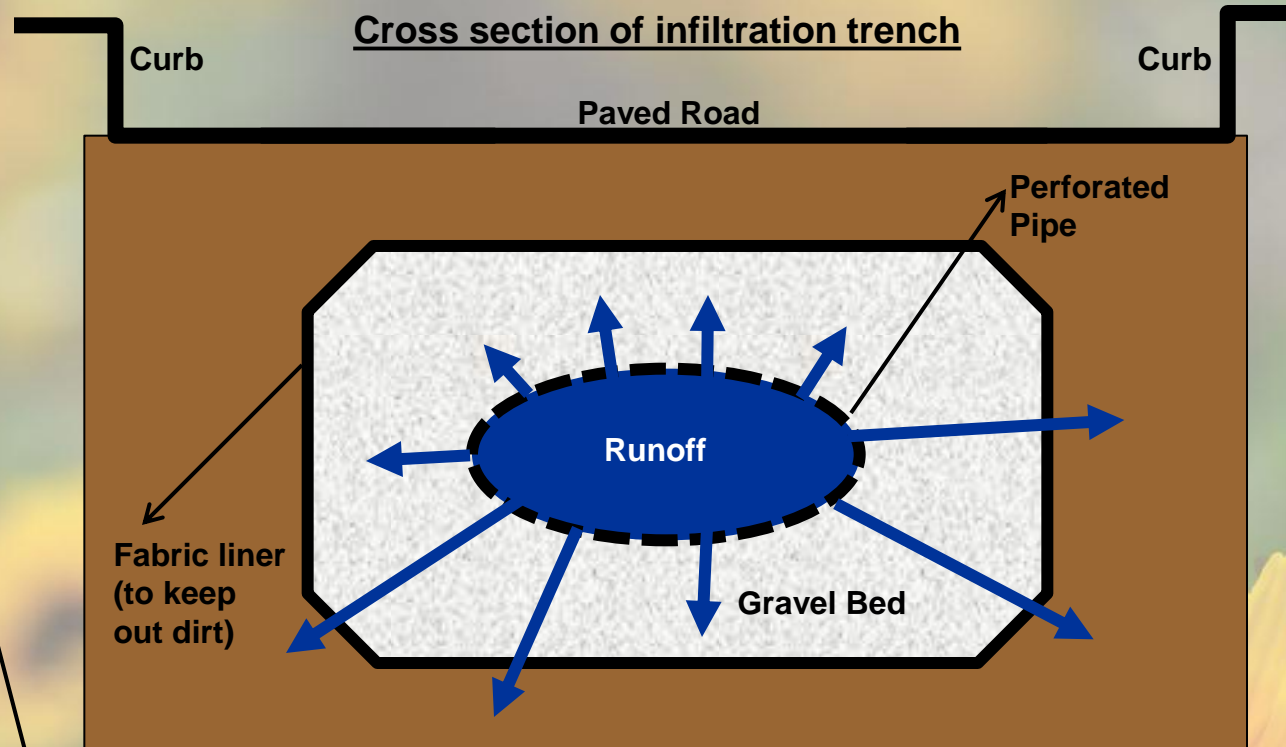
- Alleys: Broadway-Madison Ave, Madison-Jefferson Ave
- Front Street: Broadway-Jefferson, Grove-Adams Street

**About 3,612 feet of
infiltration trench installed
~nearly $\frac{3}{4}$ mile**

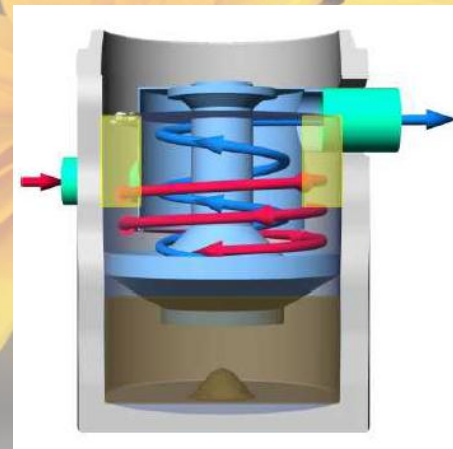
Planned BMP System: Infiltration Trenches

Treatment Steps:

1. Diversion wier directs flow to system from existing storm drain system (including water from overflow of rain gardens)
2. Pretreatment for trash, sediments via Oil/grit separator
3. Trenches fill up and infiltrate to ground, perforated pipe buried in gravel (see figure at right)
4. Overflow back to existing drain system



Pretreatment of trash and sediments provided by oil/grit separator



Planned BMP System: Installation of Infiltration Trenches



Front Street (between Boone's
Restaurant and Inland Seas
Education Association)

Planned BMP System: Installation of Infiltration Trenches



**Above: Trench Installation – note
gravel bed and size of tubes
Right: Oil/grit separator**

Planned BMP System: Wetland Treatment

- Madison outlet abandoned and redirected to wetland between marina and south docks
- Most flow to Broadway line into infiltration trench, overflow split between current outlet and wetland



New drain outlet at the end of Madison adjacent to existing wetland

Maintenance, Things to Consider, and General Observations

- Rain Gardens
 - ✓ Watch closely the first few weeks, note where water is coming in and look for erosion
 - ✓ Mulch will float until a mat forms, some will be transported into pipe
 - ✓ Clean storm inlets regularly, leaves will clog
 - ✓ Rocks will be helpful around inlets to rain garden and storm drains
 - ✓ Spring clean-up necessary – blow/rake out excess sand, grit, and leaves
 - ✓ Public prefers rain gardens with curbing



Above: Note floating mulch, gullies in newly planted gardens
Left: Mulch and leaves blocking overflow inlet to drain system

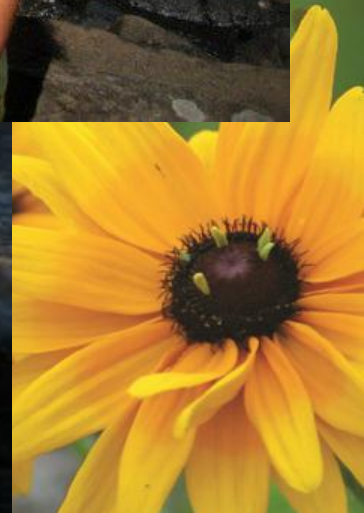
Maintenance, Things to Consider, and General Observations

- Infiltration Trenches
 - ✓ Oil grit separators must be cleaned periodically
 - ✓ Trenches must be power washed and vacuumed out at least yearly



Above and Left: Village of Suttons Bay Public Works employees clean out oil/grit separators early Winter (after heavy Fall rains)

Questions?



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